

Corruption and Shadow Economy

by

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Submitted to

Central European University

Economics Department

In partial fulfillment of the requirements for the degree of

Master of Arts in Economics

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Budapest

2008

Abstract:

In this paper I analyze the corruption and shadow economy in a special arrangement: I portray the model with the ultimate level of corruption and presence of informal sector. I am concerned about the comparison of the system above with the system of the zero level of corruption and shadow economy. Further, I investigate whether the corruption and the shadow economy are complements or substitutes.

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Introduction

Corruption and the shadow economy¹ have been the important phenomena that have attracted a great deal of attention from economics and political science. Although the common observation is that corruption and the informal sector are inherent for human societies and economic activities, there is an enormous difference of their nature in various countries and communities. For example, Transparency International (TI)² presents very different levels of corruption in Finland and Zimbabwe. A great number of empirical researches are devoted to the study of the level of shadow economy in different countries. Probably, the difference is the major motivation why economists tackle different instances of corruption and the shadow economy, starting from as early as the mid 20th century. Currently, the study of corruption and shadow economy is also highly represented in the research agenda of international organizations, such as IMF and World Bank, and OECD.

While the importance of each of the phenomena above has widely been recognized, the definitions are debated. In current paper I focus on the corruption defined as the misuse of entrusted power for private gain³. And, as for the shadow economy, I employ one commonly used definition that “unofficial economy constitutes activities that are not recorded in the government statistics” (Choi and Thum 2008).

In current work, I employ the classical example of corruption in tax collection. Corrupt officials often collude with taxpayers to understate tax liabilities with the result that tax revenues collected fall far short of their potential⁴. This amounts to tax evasion. In this context, whenever

¹ Unofficial economy, underground economy and informal economy are commonly used notions in literature which I use interchangeably throughout the study.

² Transparency International is the global civil society organization leading the fight against corruption all over the world. www.transparency.org

³ Transparency International

⁴ Hindricks *et al* (1999).

underreport of tax liabilities exist, shadow economy is generated⁵. These two important phenomena above, though being different, co-exist. A more provocative aspect of their co-existence - corruption and shadow economy being substitutes or complements are debated by many authors. Choi and Thum (2005), Dreher *et al.* (2005) and Rose-Ackerman (1997) argue that corruption and underground economy are negatively related. Friedman *et al.* (2000) and Hindricks *et al.* (1990) are in favor of corruption and shadow economy being complements. In an empirical study, Johnson *et al.* (1998) find a statistically significant positive relationship between the various measures of corruption and shadow economy. Friedman *et al.* (2000) find evidence, using data on 69 countries that greater corruption are associated with greater underground economy. Current paper contributes towards this debate in favor of corruption and the shadow economy being complements.

Additionally, several writers have pointed out that corruption slows down development⁶. Yet most studies conclude that some corruption and the shadow economy might be desirable⁷. For example, efficiency argument in favor of corruption is presented by Dreher *et al.* (2005). Choi and Thum (2005) claim that shadow economy mitigates government induced distortions hence is desirable.

Building on this debate this paper investigates whether it is optimal to have corruption free bureaucracy and respective shadow free economy (first scenario). I compare the first scenario with the second one that combines both phenomena (corruption and the shadow economy) in a setting, where ultimate level of corruption (all-encompassing, pervasive and finally, epidemic) is presented and shadow economy is generated. Both aspects arise when each taxpayer underreports revenue and tax liabilities⁸ by colluding with tax collector. This setting results in corruption presented at each level of government hierarchy (government and hired tax collector)

⁵ There are multiple determinants of the shadow economy and/or corruption. See, for example, Schneider and Enste (2000), Rose-Ackerman (1999) for the analysis about the causes of unofficial economy.

⁶ Gould and Amaro-Reyes (1983); Klitgaard (1991); See Tanzi (1998), Kaufmann and Wei (1999), Rose-Ackerman (1999) for the criticism of efficiency-enhancing view of corruption.

⁷ Leff (1964). Hutington (1968) claims positive relationship between economic growth and corruption.

⁸ Tanzi (1999) states that, one of the measures of the shadow economy refers to "... revenue not reported to, and not discovered by, the tax authorities".

and private sector (entrepreneurs are open to pay grafts and bribe), in a way that tax collectors solicit bribes, while government close eyes on their action. Current paper contributes towards the debate on the corruption and the shadow economy being complements or substitutes.

Additionally, it focus of this study lies on aggregate profit analysis. I simply assume that the aggregate profit is the sum of the profits of all actors: government, firms and tax collector. I question whether, the first scenario that seems attractive at the first sight, is always superior to the second scenario where the worst case of corruption (epidemic corruption) is presented, or not.

The current study combines such aspects of informality and corruption that are only partially presented by other related studies. These are: heterogeneous firms; both flat rate taxes and flat rate bribes as a share of gross earnings; dishonest tax collector income consisting by both of salaries and bribes; and the most important – epidemic corruption. The model presented by Dreher *et al.* (2005) sets on lump-sum grafts and the revenue of corrupt official comprising only by unofficial grafts thus neglecting taxes and officially paid remuneration (salaries, premium, etc.). Same unofficial income and lump-sum payments⁹ are the major focus of Choi and Thum (2001, 2005). Bueno de Mesquita and Hafer (2008), in the slightly different context, analyze strategic interactions between a firm, mafia that extorts grafts and a potentially corrupt government. Mafia demands lump-sum fees firms must pay to it for protection and mafia revenues constitute by only those fees. However Hindricks *et al.* partially combines the aspects above by setting up the model on both, bribes and taxes, as well as takes into tax inspector's wage and remuneration package, still bribes and taxes are given as lump sum. I set my model on flat rate taxes and bribes as a share of gross earnings and describe dishonest tax collector income as a sum of both - official salaries and unofficial bribes.

The methodology is as follows. I use analytical tools to solve for the optimal of all active agents in the economy: government, taxpayer (dishonest in the second setup), firms.

⁹ Corrupt officials revenue comprised by only license fees paid by entrepreneur as a lump-sum payment to open a shop.

The rest of the work is organized as follows. In the first section, I discuss respective research and provide some justifications for the chosen modeling technique. In the second section, the model is introduced. Finally, some general conclusions are drawn.

1. Literature Review

A large set of economic literature has been devoted to the study of corruption and shadow economy. Writers address these highly recognized complex phenomena from different perspective. A number of authors have addressed only one of the phenomena, while some consider both aspects of our realities. Notwithstanding the fact that researchers have been expressing tremendous interest in both, precise and comprehensive definitions of corruption and the shadow economy are still debated. What definition we use closely determines the focus of the study.

Starting with corruption, one commonly used definition is the following:

Corruption is an act in which the power of public office is used for personal gain in a manner that contravenes the rules of the game (Jain, 2001)¹⁰. Tanzi (1998) claims that “the most popular and simplest definition of corruption is the abuse of public power for private benefit”¹¹.

Transparency International (TI) defines corruption as the misuse of entrusted power for private gain. TI further differentiates between "according to rule" corruption and "against the rule" corruption. “Facilitation payments, where a bribe is paid to receive preferential treatment for something that the bribe receiver is required to do by law, constitute the former. The latter, on the other hand, is a bribe paid to obtain services the bribe receiver is prohibited from providing”¹². Alam (1989) gives another definition. ‘Corruption is potentially and attribute of all agent-principal relationships and as such may be defined as (1) the sacrifice of the principal's interest for the agent's, or (2) the violation of norms defining the agent's behaviour’¹³. Alam (1989) constructs taxonomy of corrupted activities by ‘examining the different ways in which officials—in their private interest—distort the correspondences established by law and policy

¹⁰ Versions of it is used by Shleifer and Vishny (1993); Dreher et al. (2005). For alternative denotations, refer to Bardhan (1997), Klitgaard (1988), Rose-Ackerman (1997). Aidt T. S. (2003) offers comprehensive analysis on the developments in the economic literature on corruption.

¹¹ Tanzi (1998), p.8.

¹² www.transparency.org

¹³ Alam (1989).

between an agent's attributes and its rights (claim to benefits) and obligations (costs it must occur)' and categorizes corruption in four different groups.¹⁴

Aidt (2003) makes different categorization of corruption. Those are:"

- (1) Efficient corruption: corruption arises to facilitate beneficial trade between agents that would not otherwise have been possible. It promotes allocative efficiency by allowing agents in the private sector to correct *pre-existing* government failures.
- (2) Corruption with benevolent principal: corruption arises when a benevolent principal delegates decision making power to a non-benevolent agent. The level of corruption depends on the costs and benefits of designing *optimal* institutions.
- (3) Corruption with a non-benevolent principal: corruption arises because non-benevolent government officials introduce inefficient policies in order to extract rents from private sector. The level of corruption depends on the incentives embodied in *existing* institutions.
- (4) Self-reinforcing corruption: the reward to corruption depends on the incidence of corruption due to strategic complementarity. The level of corruption depends, for given institutions, on history"¹⁵.

One of the earliest available studies on this issue, conducted by Leff (1964), presents efficiency aspect of corruption. His paper focuses on the effect of bureaucratic corruption on economic

¹⁴ See Alam (1989) for his version of categorization about corruption. 'He categorizes corruption into four classes: *Cost-reducing corruption*. This arises when officials seek to lower the agent's costs in some given situation below the established level. Most commonly this takes the form of tax reductions or laxity in the enforcement of some regulation; the cost saving may be shared between the official and the agent. *Cost-enhancing corruption*. The opportunities for this type of corruption present themselves in three situations. Where excess demand exists for an officially supplied good or service—including the official's time—at fixed prices, the bureaucrat may seek to appropriate the implicit rent by charging what the market will bear. This market corruption is the favorite of economists analyzing corruption. Occasions for raising costs may also arise when officials enjoy monopoly power via their control over licensing procedures. Here the official's objective is to acquire at least a part of the premium associated with the license. Finally, opportunities for raising costs arise from the misuse of an official's coercive power, e.g. in illicit tax-collection. *Benefit-enhancing corruption*. This arises whenever an official seeks to transfer benefits to an agent in excess of what is legally established, e.g., excess payments made by over-reporting work done. This may be motivated by a collusive sharing of gains, nepotism or political patronage. *Benefit-reducing corruption*. In this case officials directly appropriate benefits intended for agents, e.g., delaying payment of pension funds and appropriating the interest thereon or stealing supplies from a hospital. This form of corruption may occur whenever agents are not aware of their entitlements; and officials can reduce benefits also by employing coercion.

¹⁵ Aidt (2003).

development examining case of Chile and Brazil. It concerns bureaucrats responsible for formulating and administering government economic policies. Criticism of efficiency-enhancing view of corruption is presented by Tanzi (1998), Kaufmann and Wei (1999), Rose-Ackerman (1999), Shleifer and Vishny (1993), Dal Bo and Rossi (2007).

Dal Bo and Rossi (2007) analyzed how firm level efficiency depends on corruption employing the dataset comprising firm-level information on 80 electricity distribution firms from 13 Latin American countries for the years 1994 to 2001. Their findings show that more corruption is associated with more inefficient firms explained by the necessity of diverting managerial effort from factor coordination.

Other researchers agree that corruption might be detrimental for economic development. Shleifer and Vishny argue distortionary effect of corruption and ask why “bribery might be much more costly than its sister activity, taxation”. They present two arguments why corruption might be costly to economic development. They claim that one reason is the government weaknesses allowing government agencies to impose complementary permits in exchange of independent bribes. The second is the distortions entailed by the necessity of secrecy. Demand for secrecy might induce funding potentially useless projects and leave out the highest value projects, if the former offers better opportunity for secrecy. It also might induce the country to maintain monopolies. All mentioned leading to lower investments and growth. Alam (1989) also supports the idea that corruption appears not be beneficial for economic development.

Corruption has widely been recognized as one of the sources of the shadow economy, but what are the determinants of corruption itself? It is interesting to look at Hopkin and Rodriguez-Rose () study on the role of government intervention on corruption. As they stress, ‘It is generally in government regulation, rather than in government intervention in the economy per se, where the

opportunities for greater corruption lie’¹⁶. They found that the correlation of the corruption and the degree of regulation of business activity and labour market are robustly positive¹⁷.

Choi and *Thum* (2003) analyzed the dynamics of corruption and explored that the effect of the official’s tenure stability on the extent of corruption is determined by the information available to new (corrupt) officials¹⁸. They also address welfare aspect of the setting stating that aggregate welfare is determined by the government official’s commitment power to future demands.

Bardhan (1997) concludes that “it is probably correct to say that that the process of economic growth ultimately generates enough forces to reduce corruption”¹⁹.

Now, question arises how does corruption affect shadow economy and does it affect at all? A number of authors have presented different perspectives on the relationship of the phenomena above. Before we go further to discussing the variety of respective literature, it is worth to look at the definition of the informal economy.

The concept of informality was first introduced by ILO²⁰ mission to Kenya. One commonly used definition is the shadow economy includes all current economic activities, which contribute to the officially calculated (observed) Gross National Product²¹. De Soto (1989) defines informal sector as the set of economic units that do not comply with government-imposed taxes and

16 ‘recently been stressed that “the optimal level of government intervention is not zero” (Kaufman 2003) because government capacity to define and enforce property rights is crucial in establishing a functioning and transparent market economy. The analysis presented here goes further: We have presented evidence that key features of government intervention associated with West European welfare capitalism—social transfers, high public spend-
CORRUPTION AND THE STATE 201 ing, and even state-owned enterprises—cannot be seriously argued to be causes of corruption and, if anything, are associated with lower levels of corruption. In short, the more the government intervenes as a regulator, the more corruption we observe, but government activity as consumer and as entrepreneur has either no relationship, or a negative one, with the incidence of corruption. This confirms that the relationship between government intervention and corruption is far from straightforward, and that many of the features of “big government” associated with Western European welfare capitalism—even those now discredited on economic efficiency grounds, such as state-owned enterprises—cannot be regarded as a source of greater corruption.

¹⁷ (see also Djankov

et al. 2002; World Bank 2004b).

¹⁸ Can be considered as an example of self-reinforcing corruption in the taxonomy above.

¹⁹ Bardhan (1997). For further work on what factors stimulate corruption refer to Rose-Ackerman (1997, 1999) and Tanzi (1998).

²⁰ International Labour Organization – a specialized agency for the United Nations to deal with labor issues, founded in 1919.

²¹ This definition is used, e.g., by Feige (1989, 1994), Schneider (1994a); Frey and Pommerehne (1984); and Lubell (1991).

regulations²². Shneider and Enste (2000) provide helpful taxonomy of types of underground economic activities, presented below.

Table 1. A Taxonomy of Underground Economic Activities

Type of Activity	Monetary Transactions		Non-monetary transactions	
Illegal Activities	Trade in stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling and fraud		Barter: drugs, stolen goods, smuggling, etc. Produce or growing drugs for own use. Theft for own use.	
	Tax evasion	Tax avoidance	Tax evasion	Tax avoidance
Legal Activities	Unreported income from self-employment; wages, salaries and assets from unreported work related to legal services and goods	Employee discounts, fringe benefits	Barter of legal services and goods	All do-it-yourself work and neighbor help
Source: Rolf Mirus and Roger S. Smith (1997), p.5, with additional remarks				

What causes a shadow economy? While one school of thoughts stresses high social security and tax burden as a major influencer²³, the other school sympathize low institutional qualities, regulatory discretion²⁴, rule of law, corruption and a weak legal system as the important determinants. However, Loyaza (1996) overlaps the two schools above in his macroeconomic endogenous growth model studying the affect of the excessive taxes and regulations on the relative size of the informal sector. In his empirical study, he used MIMIC (multiple-choice-multiple-variable) approach and estimated size of informal sector in 14 Latin American countries. His findings portray positive affect of the tax burden and labour - market regulations on the relative size of the shadow economy.

²² De Soto's analysis draws from the contributions of Douglas North (1981) and Mancur Olson (1982). De Soto analyses political institutions and legal structures in the rise of informal sector.

²³ See Tanzi (1982, 1999); Johnson, Kaufmann and Zoiado-Lobaton (1998a, 1998b); De soto (1989); Schneider and Enste (2000), in addition to tax and social security burdens, emphasize complexity of the tax system; Loyaza (1996).

²⁴ Loyaza (1996) claim that labour market restrictions have positive affect on the relative size of informal sector.

Considering the macro approach as lacking the causality in relations, Schneider and Enste (2000) examine the individual decision process in understanding what factors cause increase in informal sector. Their work largely is determined by the study of Schneider and Neck (1993) that investigated how the complexity of the tax system affects the shadow economy. Their view of the notion of tax complexity relies on the aspect that more complex income tax system allows for more tax avoidance via legal tax exemptions and reductions. Schneider and Neck's study relies on Austrian 1989 tax reform and results show that the factors determining the shadow economy are not only excessive direct and indirect taxes but also the complexity of the tax system and regulatory burden. Schneider and Enste (2000) go further and estimating 76 developing, transition and OECD countries found that not only excessive tax (direct and indirect) burden, complexity of the tax system and intensity of the regulations, but rising corruption as well are determinants of the extent of the shadow economy²⁵. Dell'Annot (2003) estimating shadow economy in Italy found that tax burden "are always statistically significant and positively related to the shadow economy"²⁶.

Johnson *et al.* (1998) examine a rather provocative aspect of the co-existence of corruption and the shadow economy of being substitutes or complements, empirically investigating their relationship on 49 countries of Latin America, OECD and countries in transition from communism. They found statistically significant relationship in favour of corruption and the shadow economy being complements, using two different measures for corruption or bribery. For example, increase in TICI²⁷ by 1 point increases percentage of shadow economy by 5.1 points. Using ICRG²⁸ yields the same direction: a 1 point improvement in the corruption index is associated with decrease of the shadow economy by 8-11 percent. Johnson *et al.* (1998) further suggests that more regulation and more discretion regarding how the regulatory system operates

²⁵ Finding of Schneider (2002) yields the same results.

²⁶ Dell'Annot (2003).

²⁷ Transparency International Corruption Index, ranked between 1 and 10.

²⁸ This index ranks between 1 and 6.

leads to greater unofficial economy as a share of GDP. Additionally, they state that higher unofficial economy is associated with lower tax revenues.

Friedman *et al.* (1999) found the same tendency as Johnson *et al.* (1998) in terms of corruption and unofficial economy being complements. They showed that 1 point increase of the index of corruption increases level of shadow economy by 7,6 percentage points.

As stated by a number of researchers, political control²⁹ is detrimental on doing the business and therefore adversely influences entrepreneurial activity and economic growth³⁰. Rose-Ackerman (1997) supports the idea that factors promoting competitiveness also help to reduce corruption and divert firms from shadow to official economy. He points that policies liberalizing foreign trade and removing entry barriers are such factors.

Some scholars are in favour of the shadow economy and corruption being substitutes. For example, according to Rose-Ackerman (1997), “going underground is a substitute for bribery”. Choi and Thum (2005) use this concept as a platform for the study on corruption and the shadow economy. Johnson *et al.* (1997) hypothesize that firms go underground to avoid politization, namely: “instead of registering their activities, managers prefer not to pay taxes and not to benefit from key publicly provided services, such as legal enforcement of contracts. For the economies in transition from communism there is evidence of downward spiral, in which firms leaving the official sector reduce tax revenue, which reduces publicly provided services, and further, reduces incentive to register in the official sector. Most of the former Soviet Union has thus ended up in a ‘bad’ equilibrium with low tax revenue, high unofficial economy, and low quality of publicly provided services”³¹.

Public good provision also has been widely recognized to be in correlation with the shadow economy. Sometimes lower level of public good is considered as the result of the shadow

²⁹ Seems to be in line with corruption with non-benevolent principal of the categorization if Aidt (2003). Should be noted that in proposed categorization various definitions of corruption may overlap.

³⁰ De Soto (1989); Kaufmann (1997); Loyaza (1996).

³¹ Johnson *et al.* (1997).

economy, but at the same time lower provision of public good contributes towards the increase of informal sector. Choi and Thum (2005) claim that corruption induces provision of public good below the first-best level. Shadow economy further aggravates sub-optimal provision of the public good.

Findings of Johnson *et al* (1998b) are in line with this view. They show that countries with a big tax revenues financed from high taxes have smaller shadow economy. Findings of Johnson *et al.* (1998a) show that: “Wealthier countries of the OECD as well as some in Eastern Europe find themselves in “good equilibrium” of relatively low tax and regulatory burden, sizeable revenue mobilization, good rule of law and corruption control, and [relatively] small unofficial economy. By contrast, a number of countries in Latin America and the former Soviet Union exhibit characteristics consistent with “bad equilibrium”: tax and regulatory discretion and the burden on the firm is high, the rule of law is weak, and there is a high incidence of bribery and a relatively high share of activities in the unofficial economy”³². Hence, level of shadow economy has significant affect on public finance.

Further, Loyaza (1996), refers to only one extreme level of this correlation. By pointing that high shadow economy is associated with low extent of public infrastructure, the latter being the key element of economic growth, finds that growth rate of economy (official economy) is negatively correlated with the increase in the unofficial economy. He investigates Latin American countries and founds that 1 percentage increase of the shadow economy with respect to GDP, *ceteris paribus*, is associated with 1,22 percentage point decrease of the growth rate official economy with respect to GDP. Dell’Annot (2003) findings on Italy are also in favour of this result stating: “The relationship between underground economy and growth rate of GDP ... is negative”.

Not all researchers share the views of Loyaza (1996). Asea (1996), in criticising Loayaza (1996), points that unofficial sector may highly contribute to the “creation of markets, increase financial resources, enhance entrepreneurship, and transform the legal, social and economic institutions

³² Johnson *et al.* (1998a).

necessary for accumulation”. Moreover, the empirical findings of Schneider (1998) show that earnings in the unofficial economy are immediately spent in the official economy.

The current paper, based on analytical method, cast into question the view that the corruption and the shadow being substitutes. It also investigates the relationship of the corruption and the shadow economy with the market size, level of public good provision, tax rates and grafts.

Additionally, the current model favours the researches showing that large unofficial sector associates with small official sector. In this study, determinants are public services, tax rate, and bribes. I typically done from the perspective of corruption with benevolent principal³³ and shadow economy defined under Tanzi (1998) in understanding the informal sector and corruption. Specifically, I question how detrimental their upper extreme level of corruption and associated level of shadow economy³⁴ might be?

The model setup presented in the next chapter is highly determined by the settings designed by Choi and Thum (2005). Lump-sum bribes are modified to the flat rate bribes and flat tax rates are introduces. Then, first-best scenario of honest players associated with no extent of corruption and zero level shadow economy is compared with the second scenario with extreme level of corruption and shadow economy. I use analytical tools to solve for each players aximixation problem.

³³ See categorization of Aidt (2003).

³⁴ Worst scenario.

2. Model Setup

In an economy, the following players are present: a firm, tax collector (dishonest in the second scenario)³⁵ and government. The total number of firms³⁶ is normalized to unity. Firms are characterized by entrepreneurship ability ν in $[0,1]$. Further assume that there is continuum of entrepreneurs so that the entire distribution of entrepreneurship ability is fully represented³⁷. Distribution of abilities is given by the inverse cumulative distribution function $F(\nu)$ with continuous density $F(\nu) \leq 0$, that is $F(\nu)$ denotes the proportion of entrepreneurs generating income more than ν ³⁸. I, like Choi and Thum (2005) make standard assumption that distribution of types satisfies the monotone hazard rate function, that is $-F'/F$ is increasing³⁹. This assumption ensures that the official's objective function is quasi-concave and the second-order condition for the maximization problem is satisfied⁴⁰. The government produces a public good that enhances productivity of the entrepreneur. A firm's gross earnings are given by $\theta \cdot \nu$. The tax rate is treated as exogenous⁴¹, flat rate taxes τ are imposed on the gross earnings. Entrepreneur's choice is whether to enter the prevailing economy or not. The entrepreneur's reservation payoff from not entering the market is normalized to zero. Following Hindricks *et al.* (1999), I abstract from some features of the tax collection process that are important in some contexts. In particular, in the current model all firms meet a tax collector⁴² (who is dishonest in the second scenario). Government wishes to raise some revenue, and is concerned about public good provision. The cost of public good provision $C(\theta)$ has characteristic of that of Choi and Thum⁴³.

³⁵ First scenario assumes 'perfect' instance, when no corruption and no shadow economy can exist. All actors are honest.

³⁶ Firm and entrepreneur are used interchangeably throughout current work.

³⁷ A la Rauch (1989), Choi and Thum (2003), Choi and Thum (2005). Among the limitations of Loyaza (1996) uniformly distributed abilities are presented. This paper assumes heterogeneous entrepreneurs.

³⁸ Similar to Choi and Thum (2005).

³⁹ Choi and Thum (2005).

⁴⁰ Choin and Thum (2005).

⁴¹ A la Bueno de Mesquita and Hafer (2008). For the comprehensive analysis see Gehlbach (2007).

⁴² The model is not intended to represent any actual tax system. Indeed, part of the ultimate purpose is to compare two extreme scenarios not necessarily prevailing in any community.

⁴³ Choi and Thum (2005)

I assume that $C'(\theta) > 0, C''(\theta) > 0$ ⁴⁴. Government delegates tax collection to tax collector⁴⁵ who get salary⁴⁶ for his work⁴⁷ as a share α ⁴⁸ of overall tax revenue collected.

I first consider the scenario when neither corruption nor shadow economy exist. Then, I compare its parameters and welfare with those of the second scenario. The second scenario assumes ultimate level of corruption. That is, when corruption is epidemic, the tax collector is corrupted and pursues his own interest and not necessarily that of the government⁴⁹. The tax collector solicits bribes from the entrepreneur who enters the economy (that is corruption) and underreports tax payer's liability (thus generating shadow economy).

2.1. First Scenario – Economy without Corruption and Shadow Economy

Government wishes to maximize its revenue net of the cost public good provision and of hiring tax collector. Then, knowing government's decision on θ public good, the firm decides whether to enter the market or not. If it enters, entrepreneur is liable to pay flat rate taxes τ incurred on entrepreneurs gross earnings. Assuming only honest taxpayers and tax collectors in the economy, entrepreneur meets tax liability fully. Tax payments are turned over to the government entirely. Then, the entrepreneur who generates non-negative income enters the market with fixed cost k , that is

$$(1) \quad \Pi_{uc} = \theta \cdot v - \theta \cdot v \cdot \tau - k \geq 0$$

⁴⁴ Marcouiller and Young (1995) analyze the role of public goods for formal and informal sectors. In their model, the predatory state is the only reason for providing public goods to attract taxpayers to the formal sector; Choi and Thum (2005) declare that without shadow economy the level of public good provision is suboptimally low. And, the existence of unofficial sector aggravates the inefficient provision of the public good; Model by Johnson et al. (1997) presents same findings.

⁴⁵ Hindricks *et al.* (1999).

⁴⁶ Similar to Hindricks *et al.* (1999).

⁴⁷ In the second scenario, dishonest tax collector income consists of his salary and bribes demanded from taxpayers.

⁴⁸ α is such that $0 < \alpha < 1$ and is exogenous. The same argument that applies to exogenous minimal amount of tax revenue is valid for α .

⁴⁹ Hindricks *et al.* (1999).

where Π_{uc} denotes entrepreneurs net profit in uncorrupted environment. A marginal type who is indifferent between entry and exit is given by $v^* = \frac{k}{\theta(1-\tau)}$. Firms having entrepreneurs ability more than marginal entrepreneur does, enter the market.

Given the firm's entry decision, the government maximizes its revenue⁵⁰ net of the cost of the public good provision⁵¹ and of hiring tax collector.

$$(2) \quad \max_{\theta} R = \int_{v^*}^1 \theta \cdot v \cdot \tau \cdot dv - \alpha \cdot \int_{v^*}^1 \theta \cdot v \cdot \tau \cdot dv - C(\theta)$$

First-order condition yields:

$$(3) \quad \frac{\partial R}{\partial \theta} = \frac{(1-\alpha) \cdot \tau}{2} + \frac{(1-\alpha) \cdot \tau \cdot k^2}{2(1-\tau)^2 \theta^2} - C'(\theta) = 0$$

Solving for θ gives the level of public good provision θ^* , tax revenue, government revenue net of the cost of public good provision and cumulative income of all operating firms.

$$(*.1) \quad T^* = \int_{v^*}^1 \theta^* \cdot v \cdot \tau \cdot dv = \frac{\theta^* \tau}{2} - \frac{\tau \cdot k^2}{2(1-\tau)^2 \theta^*}$$

$$(*.2) \quad R^* = (1-\alpha) \cdot \int_{v^*}^1 \theta^* \cdot v \cdot \tau \cdot dv - C(\theta^*) = \frac{(1-\alpha) \cdot \theta^* \tau}{2} - \frac{(1-\alpha) \cdot \tau \cdot k^2}{2(1-\tau)^2 \theta^*} - C(\theta^*)$$

$$(*.3) \quad \int_{v^*}^1 \Pi_{uc}^* = \int_{v^*}^1 [\theta^* \cdot v \cdot (1-\tau) - k] \cdot dv = \frac{\theta^* (1-\tau)}{2} - \frac{(1-\tau) \cdot k^2}{2(1-\tau)^2 \theta^{*2}}$$

I simply assume that aggregate profit is the sum of the profits of all agents in the economy⁵².

That is:

$$(*.4) \quad W^* = R^* + \int_{v^*}^1 \Pi_{uc}^* = \int_{v^*}^1 \theta^* \cdot v \cdot (1-\alpha\tau) \cdot dv - k - C(\theta^*)$$

⁵⁰ Assume that tax revenue is greater than some exogenously given T . Exogenous τ , T and $C(\theta)$ ensures that government revenue net of cost of public good provision is non negative. Arguments on T being exogenous is presented later.

⁵¹ Similar to Choi and Thum (2005). Further assume that government revenue function is concave and second order condition holds..

⁵² Choi and Thum (2005) design welfare in similar way.

2.2. Second Scenario – Economy with Corruption and Shadow Economy

A dishonest tax collector, capable of extorting public power for private gain, is open to corruption. He solicits grafts as a $\xi \in (0,1)$ share of flat rate τ imposed on firm's pre-tax income. All entrepreneurs are open to pay grafts. Tax collector underreports firm's true tax liability by reporting $t \cdot \theta \cdot v$ as the firm's pre-tax income. Thus, $t \cdot \tau \cdot \theta \cdot v$ turns over to the government as the tax revenue and the remaining $(\xi - t) \cdot \tau \cdot \theta \cdot v$ is retained as a bribery income of tax collector⁵³. This introduces cost in the sense that only a fraction of a graft is actually received by the tax collector⁵⁴. As Tanzi (1999) states, one of the measures of the shadow economy refers to "... revenue not reported to, and not discovered by, the tax authorities". Following the definition⁵⁵, level of the unofficial economy is $1 - t$ that is the share of unreported pre-tax income (and activities) to the total pre-tax income (and activities).

Additionally, I assume that overall tax revenue collected should be greater or equal to some exogenously given amount, that is $\int_{v^*}^1 t \cdot \theta v \tau \cdot d v \geq T$ ⁵⁶. At the end, this is not far from what we

face in real world. Countries implementing IMF and/or World Bank programmes are often recommended on the lower limit of tax revenue to be collected.

The sequence of events is as follows. First, the government decides the level of public good provision. Next, given the government's decision, the tax collector decides on its rate of bribes $B = \xi - t$. And finally, the entrepreneur, facing the government's and tax collector's decision, chooses whether to enter the prevailing market or not. Entrepreneur who generates non-negative income enters the market with fixed cost k , that is

⁵³ Like in Loyaza (1996), bribes do not go finance public services. But, contrary to Loyaza (1996) we will see, that even with this setting the second scenario (with corruption and shadow economy) might be superior to the first scenario (with neither corruption nor shadow economy).

⁵⁴ Aidt (2003).

⁵⁵ This also relates to the definition presented in Choi and Thum (2005) - "Unofficial economy constitutes activities that are not recorded in the government statistics". But, should be noted that actual government statistics entail some part of shadow economy, though precise extent can't be measured.

⁵⁶ Later, tax collector's optimization will reveal that this inequality holds with equality.

$$(4) \quad \Pi_{ce} = \theta \cdot \nu - \xi \cdot \theta \cdot \nu \cdot \tau - k \geq 0.$$

Where Π_{ce} represents net profit if dishonest (open to corruption) entrepreneur, who pays grafts⁵⁷ to the dishonest tax collector. A marginal type who is indifferent between entry and exit is given by

$$(5) \quad \tilde{\nu} = \frac{k}{\theta \cdot (1 - \xi \cdot \tau)}.$$

Firms having entrepreneurs ability more than marginal entrepreneur does, enter the market.

Equation (5) has several natural implications:

- (a) the higher the amount of public goods, the easier is to generate revenue and firms with lower ability are capable to enter the market; threshold level $\tilde{\nu}$ is lower;
- (b) the higher the tax rate, the higher ability need by firms to enter the market and pay taxes; threshold level $\tilde{\nu}$ is higher;
- (c) the higher the cost of capital k , the higher the ability need by firms to enter the market; threshold $\tilde{\nu}$ is higher;
- (d) the lower the rate of grafts ξ , the lower the cost of firms for operating. Thus, lower ability firms can enter the market; threshold level $\tilde{\nu}$ is lower.

Given the distribution of ν , the size of the market is given by

$$(6) \quad F(\nu) = \int_{\tilde{\nu}}^1 d\nu = 1 - \tilde{\nu} = 1 - \frac{k}{\theta \cdot (1 - \xi \cdot \tau)}$$

Where, $F(\nu)$ is the share of operating firms. Market size, *ceteris paribus*, is related negatively to the capital, tax rate and rate of grafts and positively to the amount of public goods.

Revenue maximizing tax collector problem is:

$$(7) \quad \underset{B}{Max} R_{cc} = \alpha \cdot \int_{\tilde{\nu}}^1 t \cdot \theta \nu \tau \cdot d\nu + \int_{\tilde{\nu}}^1 B \cdot \theta \nu \tau \cdot d\nu$$

⁵⁷ Graft amount to some share of entrepreneur's tax liability.

$$\text{s.t} \quad \int_{\tilde{v}}^1 t \cdot \theta v \tau \cdot d v \geq T$$

The first term is tax collector's official income (salary), and the second term is unofficial income generated from bribes. From the tax collector's perspective, it is optimal that the constraint holds with equality⁵⁸.

Given B and ξ , government, like in the first scenario, maximizes its revenue net of the cost public good provision and of hiring tax collector⁵⁹.

$$(8) \quad \max_{\theta} R_{cg} = \int_{\tilde{v}}^1 t \cdot \theta v \tau \cdot d v - \alpha \cdot \int_{\tilde{v}}^1 t \cdot \theta v \tau \cdot d v - C(\theta)$$

$$\text{s.t} \quad \int_{\tilde{v}}^1 t \cdot \theta v \tau \cdot d v = T$$

The first term is tax revenue, the second and the third terms represent the costs of hiring tax collector and of public good provision, respectively. Public services are extensively financed by taxes, like in Loyaza (1996)⁶⁰.

First order condition yields the amount of public good provided $\tilde{\theta}$:

$$(9) \quad \frac{\partial R_{cg}}{\partial \theta} = -C'(\theta) = 0$$

Strategic interaction between government and tax collector can be described as follows: tax collector's action influences tax and bribe base, but the latter itself does not affect total tax revenue and the cost of provision of public good. Therefore, because of exogeneity of α , τ and T , tax collector's action has not effect on government's income. In contrast, government's optimal choice of public good provision affects tax collector in several ways. First, a public good enters positively into entrepreneur's income function and influences decision of marginal entrant, thus having impact on tax and bribery base. Second, increase in θ , *ceteris paribus*, enables tax collector to solicit higher bribes B by setting lower t .

Evaluating equation (3) at $\tilde{\theta}$ yields:

$$(10) \quad \frac{\tau}{2} + \frac{\tau \cdot k^2}{2(1-\tau)^2 \tilde{\theta}^2} - C'(\tilde{\theta}) = \frac{\tau}{2} + \frac{\tau \cdot k^2}{2(1-\tau)^2 \tilde{\theta}^2} > 0$$

⁵⁸ Remember $B = \xi - t$ and $\alpha < 1$.

⁵⁹ Assume concave function.

⁶⁰ See note 49.

This implies that $\theta^* > \tilde{\theta}$. Public good of the first setting is greater than that in the second scenario. Major reason is the smaller amount of the tax revenues (at its minimal recommended level) collected in corrupted environment.

Direct inference is that lower public good implies lower productivity of the entrepreneur characterized by ν ability. This induces a number of lower ability entrepreneurs to quit the market, thus reducing tax and bribe base. To compensate for lower tax base, tax collector has to set higher t and lower B . Consequently, tax collector might solicit smaller ξ of pre-tax earnings. This enables a number of low ability entrepreneurs to stay in the market. As a result, market size in corrupted environment compared to that of environment without corruption is determined by the relative magnitude of $\tilde{\theta}$, $\tilde{\xi}$ and τ . Specifically, market shrinks (in the second scenario) if $\theta^*(1-\tau) > \tilde{\theta}(1-\tilde{\xi}\tau)$. Effect of corruption on market size is ambiguous and is largely determined by the cost of the provision of public good.

Coming back to tax collector's problem, since the rate of bribe is uniquely determined by the rate of graft ξ , it is more convenient to treat ξ as control variable. Thus, tax collector's problem becomes:

$$(8') \quad \begin{aligned} \text{Max}_{\xi} R_{cc} &= \alpha \cdot \int_{\tilde{\nu}}^1 t \cdot \tilde{\theta} \nu \tau \cdot d\nu + \int_{\tilde{\nu}}^1 (\xi - t) \cdot \tilde{\theta} \nu \tau \cdot d\nu \\ \text{s.t.} \quad &\int_{\tilde{\nu}}^1 t \cdot \tilde{\theta} \nu \tau \cdot d\nu = T \end{aligned}$$

Solving for ξ yields optimal rate of $\tilde{\xi} = \tilde{\xi}(\tau, \tilde{\theta}, k)$ ⁶¹, which maximizes tax collector's income. It positively relates to the cost of capital (if the public good provision is not incredibly low) and the level of public good, and, negatively to the tax rate. All these results are consistent with intuition. Consider first the negative effect of tax rate τ on $\tilde{\xi}$. Other things being equal, higher τ implies that entrepreneurs have lower after-tax income, thus inducing lower ability firms stay out of market. Thus, tax and bribe base is lower. Further, higher τ , *ceteris paribus*, enables to set lower t and respective higher B . Additionally, the magnitude of change in $\tilde{\xi}$ with respect to τ depends on the values $\tilde{\xi}$ and τ themselves. If in equilibrium small $\tilde{\xi}$ persists, increase in τ induces a smaller decrease of $\tilde{\xi}$ and vice versa; and, if τ is big, further increase in τ induces

⁶¹ Derivations are presented in Appendix.

smaller decrease of $\tilde{\xi}$ and vice versa. That is, if tax collector solicits small grafts (has little power expressed as $\tilde{\xi}$), then with small increase in tax rate he has to demand smaller grafts.

High fixed cost assures that only high ability entrepreneurs enter the market, also capable to incur higher graft payments, hence ξ is big. Size of bribes itself is negatively related to the level of public good provision and the flat tax rate. The existence of the epidemic corruption means that in this environment rule of law unquestionably breaches, but the extent of it is determined by several factors: by the size of bribes and by the public good provision, partially. Therefore, combination of the latter aspect with low level of public good enables tax collector to solicit as high bribes as optimal from his perspective.

The effect of the level of public good provision has already been discussed. Here I just add that greater tax and bribe base, that is the result of greater θ , enables tax collector to demand higher grafts and bribes.

Optimal rate of grafts yields equilibrium values of marginal entrant, size of market, level of shadow economy, government income and tax collector's income.

$$(11) \quad \tilde{\xi} = \tilde{\xi}(\tau, \tilde{\theta}, k) ; \quad \tilde{v} = \frac{k}{\tilde{\theta} \cdot [1 - \tau \cdot \tilde{\xi}(\tau, \tilde{\theta}, k)]} ; \quad \tilde{T} = T$$

$$F(\tilde{v}) = 1 - \frac{k}{\tilde{\theta} \cdot (1 - \tau \cdot \tilde{\xi}(\tau, \tilde{\theta}, k))}$$

$$(12) \quad \tilde{R}_{cc} = (\alpha - 1) \cdot T + \frac{\tau \cdot \tilde{\xi}(\tau, \tilde{\theta}, k) \cdot \tilde{\theta}}{2} \cdot \left(1 - \frac{k^2}{\tilde{\theta}^2 \cdot (1 - \tau \cdot \tilde{\xi}(\tau, \tilde{\theta}, k))^2}\right)$$

$$(13) \quad \tilde{R}_{cg} = (1 - \alpha)T - C(\tilde{\theta}) \text{ and } -C'(\tilde{\theta}) = 0$$

Level of the shadow economy is given by

$$(14) \quad \lambda \equiv 1 - t = 1 - \frac{2T}{\tilde{\theta} \tau \cdot \left[1 - \frac{k^2}{\tilde{\theta}^2 (1 - \tilde{\xi} \tau)^2}\right]},$$

where t and $(1 - t)$ denote shares of reported and unreported incomes (and, relevant activities), respectively⁶². Further increase of the dishonest tax collector's power ξ (and, corruption) induces increase of the shadow economy. Enjoying more power, tax collector employs it for his private benefit rather than that of government. Hence, having incentive to increase his private

⁶² Follows the definition of Tanzi (1999).

income, diverts all incremental income (if lower tax revenue limit is met) to his pocket.

Therefore, this results in the corruption and the shadow economy being complements.

On the other hand, ξ can be considered as the cumulative degree of the government weaknesses, breach of the rule of law. Then, weak rule of law and weak government (great ξ) is associated with big shadow economy. Shleifer and Vishny states government weaknesses as one of the characteristics of corruption.

Higher the tax rate produces more shadow economy. This also is in line with the studies of many researchers⁶³. In the economy of the ultimate level of corruption, weak rule of law, passive government, increase in tax rate stimulates shadow economy.

If the recommendations set higher level for the minimal tax revenue government should collect, tax collector has to contribute towards tax revenue rather than his private gain, therefore shadow economy shrinks.

Higher the public good provision, the lower the level of the shadow economy. As it is widely accepted, higher level of public good might very well be associated with better government characterized by enhancing and effective tax system, better technologies, good protection for private sector, etc... Hence, all these aspects lead to the decreased shadow economy.

The bigger the fixed cost, the smaller the shadow economy is. Only high ability firms are capable to incur big fixed costs. Therefore, tax and bribes base reduces. This also reduces tax collector's power of demanding grafts. Hence, the share of firm's income tax collector has to declare is bigger than that evaded. Additionally, high ability firms are also capable to defend themselves and pay lower grafts (if any).

Aggregate profit is given by:

$$(14) \quad \tilde{W} = \tilde{R}_{cg} + \tilde{R}_{cc} + \int_{\tilde{v}}^1 \Pi_{ce} d\nu = \int_{\tilde{v}}^1 (\tilde{\theta} \cdot \nu - k) d\nu - C(\tilde{\theta})$$

Aggregate profit in the first scenario is lower than one in the worst scenario if the following condition holds $\theta^*(1 - \alpha\tau) < \tilde{\theta}$. Hence, for certain cost function of the public good provision and values of α and τ , aggregate profit of corrupted (and associated shadow economy) environment is greater than that of setting with neither corruption nor the unofficial economy.

Even being a pervasive, all-encompassing, epidemic, the extreme extent of corruption still might contribute to the increase of aggregate profit..

⁶³ See Tanzi (1982, 1999); Johnson, Kaufmann and Zoido-Lobaton (1998a, 1998b); De soto (1989); Schneider and Enste (2000).

Conclusion

This paper has examined various aspects of co-existence of the corruption and the shadow economy. I compared two extreme scenarios: one, economy with highly pervasive corruption (epidemic) and the associated shadow economy, and, the other – with no extent of corruption and zero level of shadow economy. By employing the classical example of tax collection, I focused on the setup that encompasses both phenomena: corruption and the shadow economy. Tax collector underreporting tax liability in exchange of bribes rises extent of corruption and giving opportunity to entrepreneur to evade tax liability amounts to the shadow economy. Scholars have studied multiple aspects of the two phenomena above, but, to my knowledge, none of them addressed the ultimate level of corruption I employed in this study. Being a pervasive, all-encompassing, epidemic, the extreme extent of corruption still contributes to the increase of aggregate profit, for certain values of parameters.

Further, this paper contributes to the literature on corruption and the shadow economy being complements in a special way. Although corruption is epidemic, pervasive, its further increase (expressed in the size of grafts dishonest tax collector solicits from entrepreneur) raises the level of the shadow economy. Enjoying more power in the economy of weak rule of law, a tax collector, via the technique of underreporting of tax liability, diverts all incremental income from grafts to his pocket (by means of increasing share of bribes in grafts) rather than contributing to the tax revenue (through increasing share of taxes in grafts). The more income from graft is underreported, the higher the level of unofficial economy.

Additionally, other results of the paper are also in line with the literature. In the economy of weak rule of law, corrupted tax authorities, increase in tax rate or decrease in the level of public good, *ceteris paribus*, expands the level of the shadow economy.

Current study, as stressed above, showed that the system of extensive corruption and associated level of shadow economy might not be the “worst”, at least for some agents in the economy.

Appendix

A.1. Dishonest Tax Collector's Maximization Problem

$$Max_{\tilde{v}} R_{cc} = \alpha \cdot \int_{\tilde{v}}^1 t \cdot \tilde{\theta} v \tau \cdot dv + \int_{\tilde{v}}^1 B \cdot \tilde{\theta} v \tau \cdot dv$$

$$\text{s.t.} \quad B = \xi - t$$

$$\text{s.t.} \quad \int_{\tilde{v}}^1 t \tilde{\theta} v \tau \cdot dv \geq T$$

$$\text{and } \tilde{v} = \frac{k}{\tilde{\theta} \cdot (1 - \xi \cdot \tau)}$$

Remember from the analysis in the main body that second constraint holds with equality. Then, plugging constraints and treating ξ as control variable yields the following maximization problem for dishonest tax collector:

$$Max_{\xi} R_{cc} = \alpha \cdot \int_{\tilde{v}}^1 t \cdot \theta v \tau \cdot dv + \int_{\tilde{v}}^1 (\xi - t) \cdot \theta v \tau \cdot dv$$

$$\text{s.t.} \quad \int_{\tilde{v}}^1 t \cdot \theta v \tau \cdot dv = T$$

$$FOC_{\xi} : \quad 1 - \frac{k^2}{\tilde{\theta}^2} \cdot \left(\frac{\xi}{(1 - \xi \cdot \tau)^2} \right)' = 0$$

Then, $\tilde{\xi}$ is the solution to the first order constraint. Solving $k^2 \cdot (1 + \xi \cdot \tau) = \tilde{\theta}^2 \cdot (1 - \xi \cdot \tau)^3$ present as a cubic equation:

$$-\tilde{\theta}^2 (\xi \cdot \tau)^3 + 3\tilde{\theta}^2 (\xi \cdot \tau)^2 + (-3\tilde{\theta}^2 - k^2) (\xi \cdot \tau) + (-\tilde{\theta}^2 - k^2) = 0$$

Of the type $z^3 + a_2 z^2 + a_1 z + a_0 = 0$

Then, make major definitions to solve the cubic equation:

$$z \equiv x - \frac{a_2}{3}$$

$$p \equiv \frac{3a_1 - a_2^2}{3}$$

$$q \equiv \frac{9a_1a_2 - 27a_0 - 2a_2^3}{27}$$

$$x = w - \frac{p}{3w}$$

$$w^3 = \frac{1}{2}q \pm \sqrt{\frac{1}{4}q^2 + \frac{1}{27}p^3}$$

And

$$\xi \cdot \tau \equiv z$$

$$a_2 = -3$$

$$a_1 = 3 + \frac{k^2}{\tilde{\theta}^2}$$

$$a_0 = -1 + \frac{k^2}{\tilde{\theta}^2}$$

Solving, yields:

$$\tilde{\xi} = -\frac{1}{\tau} \cdot \sqrt[3]{\frac{k^2}{\tilde{\theta}^2} + \frac{k^2}{\tilde{\theta}^2} \sqrt{1 - \frac{1}{27} \cdot \frac{k^2}{\tilde{\theta}^2}}} + \frac{1}{3\tau} \cdot \sqrt[3]{\frac{(\frac{k^2}{\tilde{\theta}^2})^3}{\frac{k^2}{\tilde{\theta}^2} + \frac{k^2}{\tilde{\theta}^2} \sqrt{1 - \frac{1}{27} \cdot \frac{k^2}{\tilde{\theta}^2}}} + \frac{1}{\tau}} \text{ and } 0 \leq \xi \leq 1 \text{ for any values}$$

of k and θ .

$$\frac{\partial \tilde{\xi}}{\partial \tau} = -\frac{1}{\tau} \cdot \tilde{\xi} < 0$$

$$\frac{\partial \tilde{\xi}}{\partial k} > 0 \text{ for any values of } \theta \text{ and } k \text{ if } \tilde{\theta} > 2,67. \text{ If } \tilde{\theta} < 1,45 \text{ then the inequality does not hold}$$

for neither values of θ and k . In between, it holds for some combination of θ and k . Current analysis designs θ big enough.

$$\frac{\partial \tilde{\xi}}{\partial \tilde{\theta}} > 0.$$

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